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Lower Falls

Grand Canyon of the Yellowstone

Formation

The Grand Canyon of the Yellowstone has been celebrated in paintings, photographs, poetry, and prose since the time it was first captured on canvas by painter Thomas Moran. Its depth and colors result from the combined forces of fire, ice, and water.

The current canyon dates back to the end of the last glaciation, 14,000 years ago. Melt waters associated with the last glaciation carved the current V-shaped valley. Water continues to erode hydrothermally-altered volcanic rocks. The hydrothermal activity makes the volcanic rocks easier to erode and causes the colors in the canyon's walls.

About the Falls

The Upper and Lower Falls are formed by the Yellowstone River as it flows over rhyolite rocks resistant to erosion. The first falls, Upper Falls, is 109 feet high; it can be seen from the Brink of the Upper Falls Trail, from the beginning of the Brink of the Lower Falls

FREQUENTLY ASKED QUESTIONS

Where can I see the canyon/falls?
Lower Falls: (Photo at left.) North Rim at Inspiration, Lookout & Red Rock Points, plus the brink overlook; South Rim at Artist Point, from Uncle Tom's Trail, and from a few places along the South Rim Trail.
Upper Falls: (Photo next page.) North Rim, at the beginning of Brink of the Lower Falls trail, from viewing area between exit of North Rim drive and entrance to South Rim Drive; South Rim, from two viewpoints at Uncle Tom's Parking Area.

What causes the different colors in the canyon?
The colors are caused by the oxidation of iron compounds in the rhyolite rock, which has been hydrothermally altered. You could say the canyon is "rusting."

Is there a place where I can see both falls at once?
No. The canyon bends between the Upper and Lower falls, so there is no location where they can be seen at the same time.

How tall are the falls?
Upper Falls: 109 ft; Lower Falls: 308 ft.

How big is the canyon?
The canyon is roughly 20 miles long. It varies from 800 to 1,200 feet deep, and is 1,500 to 4,000 feet wide.

How can I get to the bottom of the canyon?
Only one trail in this area leads to the bottom of the canyon—Seven Mile Hole Trail, a strenuous, steep round trip of 11 miles.

How much water goes over the falls?
The volume varies from 63,500 gallons per second at peak runoff to 5,000 gallons per second in the late fall.

What causes the green stripe in the Lower Falls?
A notch in the lip in the brink makes the water deeper and keeps it from becoming turbulent as it goes over the edge.

Who was Uncle Tom?
"Uncle Tom" Richardson was an early concessioner in the canyon area. He guided visitors to the canyon bottom down a steep trail using rope ladders. (This is the present Uncle Tom's Trail, which descends partway into the canyon via steep steel steps.) He lost his permit in 1906 after the Chittenden Bridge was completed.

What are the large birds that look like eagles?
They are osprey, and they nest in the canyon from late April until late August or early September. Look for nests from Grandview, Lookout, and Artist points.

Revised

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Canyon

Trail, and from viewpoints at Uncle Tom's Parking Area. The Lower Falls is 308 feet high and can be seen from Lookout Point, Red Rock, Artist Point, Brink of the Lower Falls Trail, and from various points along the South Rim Trail. A third falls, Crystal Falls, enters the canyon between the Upper and Lower falls. It is a waterfall on Cascade Creek and can be seen from the South Rim Trail just west of Uncle Tom's parking area.

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Above: The Upper Falls
Right: Glacial Boulder, on the road to Inspiration

Colors in the Canyon

The colors in the canyon are a result of hydrothermal alteration of iron compounds in the rhyolite. Exposure to the elements caused the rocks to change colors as they oxidized. The colors indicate the presence or absence of water in the individual iron compounds. Most of the yellows in the canyon result from iron and sulphur in the rock.

Wildlife

Look carefully among the canyon's rugged pinnacles for osprey soaring over the Yellowstone River or perched on their five-foot diameter nests. Since the mid 1980s, six to ten osprey nests have been occupied in the portion of the canyon near Canyon Village.

Adult osprey return here between mid April and early May, depending on weather patterns. By mid May, the female is incubating two to four tan-with-brown speckled eggs. The eggs hatch in about six to eight weeks. By mid to late August, the young are nearly the size of their parents and become increasingly independent. Typically, the entire family abandons the canyon by Septem-ber, probably roosting in trees nearer to the waters where they catch fish.

Sometime during autumn, the entire population of Yellowstone osprey heads south to their wintering areas along the coasts of Mexico and Central America.

You may also see ravens, bald eagles, and swallows flying throughout the canyon. Away from the canyon rims, you may see mule deer, moose, red foxes, grizzly and black bears, coyotes, Stellar's jays, and great gray owls. During the peak wildflower season in July, a variety of butterflies feast on the abundant flowers in the meadows.

Hayden Valley

The Yellowstone River flows through Hayden Valley between Yellowstone Lake and the Grand Canyon of the Yellowstone. The valley was once filled by a lake and, consequently, contains fine-grained lake sediments that are now covered with glacial till left from the most recent glacial retreat 14,000 years ago. Because the glacial till contains many different grain sizes, including clay and a thin layer of lake sediments, water cannot percolate quickly into the ground. Thus, Hayden Valley is marshy and has few trees.

Wildlife

Hayden Valley is one of the best places in the park to view a wide variety of large mammals. Grizzly bears are often seen in the spring and early summer when they may be eating winter-killed animals or preying upon elk calves. Large herds of bison may be viewed in the spring, early summer, and during the rut, which usually begins late July to early August. Coyotes can almost always be seen in the valley; wolves are also sometimes seen.

Birds are abundant. Shore birds feed in the mud flats at Alum Creek. A pair of sandhill cranes usually nests at the south end of the valley. Ducks, geese, and American white pelicans cruise the river. Bald eagles and osprey hunt for fish along the river; northern harriers fly low looking for rodents in the grasses. Great gray owls are sometimes seen searching the meadows for food (these birds are sensitive to human disturbance).

Mt. Washburn

Mt. Washburn, named for General Henry Dana Washburn, leader of the 1870 Washburn–Langford–Doane Expedition, is the highest peak in the Washburn Range. It rises 10,243 feet and can be seen from many locations in the park. It is a remnant of an extinct stratovolcano from the Absaroka Volcanics of about 50 million years ago. The volcano was literally cut in half by collapse of the Yellowstone Caldera 640,000 years ago. Only the northern part of the original volcano is still visible. Bighorn sheep and wildflowers can be seen on its slopes in the summer, and black and grizzly bears are sometimes seen here. And it is an excellent place to view the Yellowstone Caldera to the southeast.

DAY HIKES

Mary Mountain: Moderately strenuous due to length; 21 miles one way. Climbs gradually up over Mary Mountain and the park's Central Plateau to the Nez Perce trailhead between Madison and Old Faithful. Can be hard to follow because bison knock down trail markers; also sometimes closed due to bear activity. Trailhead: north of Alum Creek pullout, 4 miles south of Canyon Junction.

Howard Eaton, Canyon to Norris portion: Moderately easy; little vertical rise; 3 to 12 miles one way; 2 to 8 hours, depending on how far you go. Passes through forest, meadow, and marshland to Cascade Lake (3 miles), Grebe Lake (4¼ miles), Wolf Lake (6¼ miles), Ice Lake (8¼ miles), and Norris Campground (12 miles). Can be very wet and muddy through July with many biting insects. Trailhead: pullout ¼ mile west of Canyon Junction on the Norris–Canyon Road. *See also Ice Lake Trail in the Norris Area.*

***Cascade Lake:** Easy; 5 miles round trip; 3 hours. Passes through open meadows and over small creeks. Can be very wet and muddy through July. Trailheads: pullout ¼ mile west of Canyon Junction on the Norris–Canyon Road or Cascade Lake Picnic Area, 1½ miles north of Canyon Junction on the Tower–Canyon Road.

***Observation Peak:** Strenuous; 11 miles round trip. The trail passes through open meadows to Cascade Lake *(see above),* then climbs 1,400 feet in three miles to a high mountain peak for an outstanding view of the Yellowstone wilderness. No water available. Not recommended for persons with heart and/or respiratory problems. Trailheads: *See Cascade Lake, above.*

Grebe Lake: Moderately easy; little vertical rise; 6 miles round trip; 3 to 4 hours. Follows old fire road through meadows and forest, some of which burned in 1988. At the lake you can connect with the Howard Eaton Trail *(see above).* Trailhead: 3½ miles west of Canyon Junction on the Norris–Canyon Road.

Seven Mile Hole: Strenuous; 11 miles round trip; 6 to 8 hours. Follows the canyon rim for the first 1½ miles, at which point you can see Silver Cord Cascade across the canyon. After another half mile joins the Washburn Spur Trail; after another 3 miles, the trail drops off to Seven Mile Hole, a 1½ mile, 1,400 foot drop. **Caution:** watch your footing and conserve your energy. Be especially careful where the trail passes both dormant and active hot springs. Off-trail travel is prohibited. Not recommended for persons with heart and/or respiratory problems. Trailhead: Glacial Boulder pullout on Inspiration Point Road.

Road work in the area may affect trailhead access.

- The road from Canyon Junction north to Chittenden Road, including Dunraven Pass, is closed for reconstruction.
- Road work may cause delays from Canyon Junction south to Fishing Bridge, through Hayden Valley.

*Cascade Lake Picnic Area may not be accessible due to road work.

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Major Areas: Lake & Fishing Bridge

FREQUENTLY ASKED QUESTIONS

Why can't we fish from Fishing Bridge?
Overfishing for cutthroat trout here contributed to their decline in the lake. The trout also spawn here. For these reasons, fishing is prohibited from the bridge.

What happened to the old campground at Fishing Bridge?
The National Park Service campground was located where bears came to fish, and many human/bear conflicts occurred. A recreational vehicle park, operated by a concessioner, still exists in the area.

How big is Yellowstone Lake? How deep? Is it natural?
The lake is natural and has 131.7 square miles of surface area and 141 miles of shoreline; it is 20 miles long by 14 miles wide. Its deepest spot is about 430 feet; its average depth is 140 feet. The lake's basin has an estimated capacity of 12,095,264 acre-feet of water. Because its annual outflow is about 1,100,000 acre-feet, the lake's water is completely replaced only about every eight to ten years. Since 1952, the annual water level fluctuation has been less than six feet.

Is Yellowstone Lake the largest lake in the world?
No, but it is the largest lake at high elevation (above 7,000 feet) in North America.

Where does the Yellowstone River begin? Where does it end?
It begins on the slopes of Younts Peak in the Absaroka Mountains southeast of the park and completes its 671-mile run by joining the Missouri River near the Montana/North Dakota border. Its waters then travel to the Mississippi River and into the Atlantic Ocean at the Gulf of Mexico. It is the longest undammed river in the United States.

What kind of fish live in the lake?
Yellowstone cutthroat trout, longnose dace, redside shiners, longnose suckers, lake chubs, and lake trout. You can often see cutthroat trout and longnose suckers from Fishing Bridge; lake trout live in deeper waters; the others are minnows that are harder to see.

Which fish are natives?
Yellowstone cutthroat trout and the longnose dace are natives.

Where can I see moose?
In marshy areas, particularly at Fishing Bridge and along Pelican Creek, and in large meadows near Bridge Bay. The best time to look is at dawn and dusk.

What's that smell at Mud Volcano?
That "rotten egg" smell comes from hydrogen sulfide gas. Sulphur, in the form of iron sulfide, gives the features their many shades of gray.

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About Yellowstone Lake

The lake area lies in a stunning setting with the Absaroka Mountains as a backdrop to the east, but this area has not always been so peaceful. The lake's basin is part of the caldera formed after the last major volcanic eruption 640,000 years ago. Originally the lake was 200 feet higher than today and extended north across Hayden Valley to the base of Mt. Washburn. The arms of the lake were formed by uplift along fault lines and sculpting by glaciers.

Geologists think Yellowstone Lake originally drained south via the Snake River into the Pacific Ocean drainage. The lake now drains north from its outlet at Fishing Bridge. The elevation of the lake's north end does not drop substantially until LeHardys Rapids, which is considered the actual northern boundary of the lake.

One of the resurgent domes from the last major eruption—Sour Creek, east of LeHardys Rapids—currently has a net uplift of about one half-inch per year. This uplift is causing the lake to tilt southward. Larger sandy beaches can now be found on the north shore of the lake, and flooded areas can be found in the southern arms.

The area of the lake known as West Thumb is a caldera within a caldera. It was formed by a

volcanic explosion that occurred about 162,000 years ago. The resulting caldera later filled with water forming an extension of Yellowstone Lake. *(For more about the West Thumb area, see page 188.)*

Water Temperatures

During late summer, Yellowstone Lake becomes thermally stratified with several water layers having different temperatures. The topmost layer rarely exceeds 66°F, and the lower layers are much colder. Because of the extremely cold water, survival time for anyone in the lake is estimated to be only 20 to 30 minutes. In winter, ice thickens on Yellowstone Lake, and it varies from a few inches to more than two feet with many feet of snow on top of the ice.

Yellowstone River

The Yellowstone River is the longest major undammed river in the lower 48 states, flowing 671 miles from its source southeast of Yellowstone National Park to the Missouri River. The river begins in the Absaroka Mountain Range on Younts Peak and flows through the Thorofare region into Yellowstone Lake. It leaves the lake at Fishing Bridge and flows north over LeHardys Rapids and through Hayden Valley. After this peaceful stretch, the river crashes over the Upper and Lower falls of the Grand Canyon. It then flows generally northwest, meeting the Lamar River at Tower Junction. The river continues through the Black Canyon and leaves the park near Gardiner, Montana. The Yellowstone River continues north and east through Montana and joins the Missouri River just over the North Dakota state line.

Wildlife

This area's abundant and diverse wildlife attracts many visitors. The lake is home to the largest population of Yellowstone cutthroat trout in North America, which are now threatened by non-native lake trout. The area around the lake is prime grizzly bear habitat. The Fishing Bridge area, including Pelican Valley to the north and east, is especially significant to bears and other wildlife because lake, river, and terrestrial ecosystems merge here to create a diverse natural complex unique inside and outside the park. Bears visit numerous streams in the spring and early summer to eat spawning trout. Hayden Valley is known for herds of bison. During the rut in August traffic can be stopped for hours by huge herds of milling bison. During the winter, Pelican Valley is another outstanding place to view bison. While river otters are elusive, they are seen with some regularity at the Bridge Bay Marina during the summer. American white pelicans, bald eagles, and osprey are commonly seen in the Lake area.

A pre-1973 crowd on Fishing Bridge

Viewing Fish

The original Fishing Bridge was built at the lake's outlet in 1902. It was a rough-hewn corduroy log bridge with a slightly different alignment from the current bridge. The existing bridge was built in 1937. Fishing Bridge, situated over a cutthroat trout spawning area, used to be a tremendously popular place to fish, but it was closed to fishing in 1973. Since that time, the bridge has become a popular place to observe fish.

Trout can also be viewed at LeHardys Rapids, three miles north of Fishing Bridge. In spring, cutthroat trout rest in the pools before leaping up the rapids on their way to spawn under Fishing Bridge. The rapids were named for Paul LeHardy, a member of the 1873 Jones Expedition. Harlequin ducks once frequented this area in spring, but have not been seen for several years. Nevertheless, the boardwalk is closed in early spring to protect the sensitive habitat.

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Lake & Fishing Bridge

Historic Structures & Areas

Fishing Bridge Trailside Museum

Lake Fish Hatchery Historic District including Lake Lodge

Lake Hotel

See Chapters 1 and 8 for more information on historic areas in the park.

Mud Volcano/Sulphur Caldron

When the Washburn Expedition explored the area in 1870, Nathaniel Langford described Mud Volcano as the "greatest marvel we have yet met with." Although the Mud Volcano can no longer be heard from a mile away (as it could then) nor does it throw mud from its massive crater, the area is still intriguing. A short loop trail from the parking lot passes the Dragon's Mouth and the Mud Volcano and is wheelchair accessible. The half-mile upper loop trail via Sour Lake and the Black Dragon's Caldron is relatively steep. A trail guide is available at the beginning of the boardwalk.

The hydrothermal features at Mud Volcano and Sulphur Caldron—primarily mudpots and fumaroles—are among the park's most acidic. Hydrogen sulfide gas is present deep in the earth at Mud Volcano. As this gas combines with water and the sulphur is metabolized by thermophiles (heat-loving microorganisms), a solution of sulfuric acid is formed that dissolves the rock to create pools and cones of clay and mud. Along with hydrogen sulfide, other gases such as steam and carbon dioxide explode through the mud. The Sulphur Caldron is among the most acidic springs in the park with a pH of 1–2.

DAY HIKES

Pelican Creek: Easy; 1.3 mile round trip. Passes through a forest to the lake before looping back across the marsh along Pelican Creek to the trailhead. Scenic introduction to a variety of the park's habitats and a good place for birding. Trailhead: west end of Pelican Creek Bridge, 1 mile east of Fishing Bridge Visitor Center.

Natural Bridge: Easy; 3 miles round trip. Meanders through the forest for about ¼ mile, then joins the Natural Bridge service road and continues to the right (west) for 1 mile to the Natural Bridge. The bridge is a 51-foot cliff of rhyolite rock cut through by Bridge Creek. A short but steep trail to the top of the bridge starts in front of the interpretive exhibit panel. The top of the bridge is closed to hiking. Trailhead: just south of the Bridge Bay Marina parking lot near the campground entrance road. Alternate route: Begin at the Natural Bridge service road, which is also a bicycle trail, ¼ mile south of Bridge Bay junction. Inquire at Fishing Bridge Visitor Center about trail closures before hiking or bicycling these trails; they are closed from late spring to early summer due to bears feeding on spawning trout in Bridge Creek.

Storm Point: Easy; 2.3 miles round trip. Passes by Indian Pond before turning right (west) into the forest. Continues through the trees out to scenic, windswept Storm Point (look for yellow-bellied marmots); then follows shoreline to the west, loops through lodgepole pine forest and returns to Indian Pond. Trailhead: Indian Pond pullout, 3 miles east of Fishing Bridge Visitor Center.

Elephant Back Mountain: Moderately strenuous 3.6 miles. Climbs 800 feet in 1½ miles through a dense lodgepole pine forest. At one mile, splits into a loop. Left fork is the shortest and least steep route. Overlook provides a panoramic view of Yellowstone Lake and the surrounding area. Trailhead: pullout 1 mile south of Fishing Bridge Junction.

Howard Eaton, Fishing Bridge portion: Easy; 7 miles round trip. Follows the Yellowstone River from Fishing Bridge for a short distance, joins a service road for ¼ mile, then meanders for 3 miles through meadow, forest, and sagebrush flats with frequent views of the river. Wildlife and waterfowl are commonly seen here. The last mile passes through a dense lodgepole pine forest before reaching an overview of LeHardys Rapids. Trail continues 12 miles to the South Rim Drive at Canyon, but is not well maintained and such a trip requires a full day and a car shuttle. Trailhead: east side of Fishing Bridge. Inquire at the Fishing Bridge Visitor Center about trail closures before hiking; the trail is often closed due to bear activity.

Avalanche Peak: Strenuous; 4 miles round trip. Climbs 1,800 feet in 2½ miles without switchbacks. Passes through forest and into old avalanche slide area, continues through whitebark pine forest to a small meadow at the base of the bowl of Avalanche Peak, affording some of the best panoramic views in the park. Continues up a scree slope along the narrow ridgeline. An unmarked trail drops down the northeast side of the bowl and returns to the meadow. Whitebark pine cones are a favored food of grizzlies in late summer and fall, so avoid this trail at that time. Trailhead: west end of Eleanor Lake across the road east of the small creek.

Pelican Valley: Moderately strenuous; 6.8 miles round trip. Travels through forest to Pelican Valley, then follows Pelican Creek upstream to a washed-out footbridge, which is a convenient turn-around point. Because Pelican Valley provides some of the best grizzly habitat in the lower 48 states, this trail does not open until July 4th and travel is restricted to specific times of day. Groups of four people or more are recommended but not required. Trailhead: end of a gravel road, which is 3 miles east of Fishing Bridge Visitor Center and across the road from Indian Pond.

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Major Areas: Madison & West Entrance

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National Park Mountain overlooking the Madison River

FREQUENTLY ASKED QUESTIONS

Why is the bridge called "Seven Mile Bridge"?
Seven Mile Bridge is located midway between (and seven miles from both) the West Entrance and Madison Junction. This landmark serves as a convenient reference point and separates the rugged lava-lined Madison Canyon east of the bridge from gentle hills to the west.

Why are there no bison around here from late June through August?
Bison that inhabit the Madison–Norris–West Entrance areas most of the year are part of the Mary Mountain herd. In summer, they travel to Hayden Valley, their traditional summer habitat and breeding area.

What is happening to so many of the young lodgepole pines in the dense stands west of Seven-Mile Bridge? Why are the needles turning orange?
Scientists have determined that no disease or insect is causing the problem. They think the trees are showing effects of three years cumulative drought stress and low winter snow pack. These conditions can cause "winter burn"—trees can't absorb enough water, and parts of the trees begin to die. New growth usually replaces the dead needles.

Geology and Vegetation

Mt. Jackson rhyolite, which is between 930,000–1,000,000 years old, forms the Madison Canyon, which lines the east half of the west entrance road. This lava flow predates the most recent eruption and collapse of the Yellowstone caldera. Mt. Haynes (south of the road) and Mt. Jackson (on the opposite side of the road), at the west end of the canyon, prominently display columnar rhyolite, a striking form of lava that is rare in Yellowstone. Lava Creek tuff from the last caldera eruption caps the Mt. Jackson rhyolite on the north side of the canyon.

West of Seven-Mile Bridge, the low topography of the Madison Valley consists of glacial moraines, glacial outwash, and recent Madison River deposits. Extensive stands of young lodgepole pines now flourish in these soils. The pines grew as a result of the North Fork Fire, one of the largest of the 1988 fires, which burned the existing forests. As fire killed the lodgepole pines, it also caused the release of millions of seeds from abundant serotinous cones immediately after the fire. Subsequent growth of dense even-aged stands of lodgepole pines since 1988 attest to the high degree of serotiny along this part of the West Entrance Road. See Chapter 5 for more information on serotiny in lodgepole pines.

Wildlife

Several hundred elk live year-round along the Madison. During the fall rut, bull elk and their harems frequent the meadows from Seven-Mile Bridge to Madison Junction.

During spring, fall and winter, herds of bison favor the same meadows. Bison often use the entrance road to travel from one foraging area to another.

Bald eagles have nested in a snag south of the entrance road about one mile west of Seven-Mile Bridge in 2002 and 2003; this pair produced one eaglet each year. The eagles' large stick nest had been used in recent years by Canada geese and osprey, but was originally constructed by bald eagles at least 40 years ago. Several pairs of ospreys nest along the Madison. A pair of trumpeter swans claimed a territory immediately east of Seven-Mile Bridge until the male died in the summer of 2001; the female remains in the area but did not have a new mate in 2003. Numerous trumpeter swans migrate from Canada to winter on the Madison. Canada geese, mallards and other waterfowl inhabit the Madison River year-round. Barrow's goldeneyes gather on the Madison in winter.

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Madison & West Entrance

Historic Structures & Areas

Madison Trailside Museum

See Chapters 1 and 8 for more information on historic areas in the park.

Madison Junction

At Madison Junction, the Gibbon River joins the Firehole River to form the Madison River. (The Gibbon River flows from Grebe Lake through the Norris area to Madison Junction. The Firehole River starts south of Old Faithful and flows through the park's major hydrothermal basins north to Madison Junction.) The Madison joins the Jefferson and the Gallatin rivers at Three Forks, Montana, to form the Missouri River.

Madison Junction lies within eroded stream channels that cut through lava flows after the last major volcanic eruption. National Park Mountain is actually part of the lava flows.

People have camped here and at Norris for thousands of years. Archeological digs in both campground areas have found campfire remnants, obsidian flakes, and bone fragments dating back at least 10,000 years.

Terrace Spring

This hydrothermal area lies north of Madison Junction and can be reached via a short boardwalk. The runoff from the springs passes under the road and flows down a long slope to the Gibbon River. Yellow monkey flowers line the runoff channels in season.

Gibbon Falls

Traveling north from Madison Junction past Terrace Springs, the road follows the Gibbon River upstream. Approximately 4 miles from Madison, the 84-foot Gibbon Falls marks in spectacular fashion one of the locations of remnants from the caldera rim. The actual rim is southwest about one-quarter mile.

Firehole Canyon Drive

Traveling south from Madison Junction, the road follows the Firehole River upstream. Approximately one mile from Madison, Firehole Canyon Drive (one way, south bound) winds past 800-feet-thick lava flows to 40-foot Firehole Falls. The West Yellowstone Rhyolite Flow is to the west and occurred 108,000 years ago; the Nez Perce Rhyolite Flow is to the east and occurred 153,000 years ago.

The unstaffed swimming area here is popular on warm summer days. Cliff diving is illegal. Swimming is usually prohibited during spring and early summer due to high water and strong current.

DAY HIKES

West Entrance Area

Riverside Trail: Easy; one mile. Leads from West Yellowstone to the Barns Road, which intersects the West Entrance Road one mile east of the West Entrance. The Riverside Trail provides hikers with easy access to the Madison River. This trail and the Barns Road are also open to bicycles. Trailhead: Boundary Street in West Yellowstone.

Gneiss Creek Trail: Easy; 14 miles one way. For the first mile, the trail follows the Madison River, then climbs over a ridge and heads north through forests and sagebrush meadows burned in 1988. The last few miles of the trail traverse aspen and Douglas fir forests where wildflowers and songbirds abound. Stream crossings are easy after the end of June. Trail ends at the Fir Ridge Trailhead on Highway 191, eight miles north of the West Entrance. Trailhead: Immediately east of Seven Mile Bridge.

Two Ribbons: Easy; half-mile round trip. Boardwalk winds through burned lodgepole and sagebrush communities next to the Madison River, with good examples of fire recovery and buffalo wallows, interpreted by wayside exhibits. Trailhead: large pullout approximately 3 miles east of West Entrance.

Madison Area

Purple Mountain: Strenuous; six miles round trip. Ascends 1,500 feet through intermittent burned lodgepole forest to views of Firehole Valley, lower Gibbon Valley, and Madison Junction area. Trailhead: ¼ mile north of Madison Junction along Mammoth–Norris Road.

Harlequin Lake: Easy; 1 mile round trip. Ascends through burned lodgepole forest to a small, marshy lake popular with mosquitoes and waterfowl (but not harlequin ducks). Trailhead: 1½ miles west of Madison Campground on West Entrance Road.

Gallatin Area

Excellent long-distance hikes available in the Gallatin area north of West Yellowstone. Consult a ranger at visitor centers or one of the trail guides available from the Yellowstone Association.

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Major Areas: Mammoth Hot Springs

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FREQUENTLY ASKED QUESTIONS

Are the springs drying up?
No, even though they may look different from the last time you saw them. These features change constantly and sometimes overnight, but the overall activity of the entire area and the volume of water discharge remain relatively constant.

Are the elk outside the visitor center tame?
No. They are wild and unpredictable. In the spring, cows with calves can be dangerous. In the late summer and fall, which is the mating season, cows are skittish and bulls are very aggressive. Each year visitors are chased, trapped, and sometimes injured by elk. Bull elk also sometimes attack cars.

What were these old buildings?
The row of stone and wood buildings across the street from the Mammoth Hotel were the officers' quarters for the U.S. Army from 1891 to 1918. A self-guiding trail takes visitors through Fort Yellowstone, a National Historic Landmark.

Can we swim in the hot springs?
No. Swimming is prohibited in park hydrothermal features because it damages the resource and is unsafe. However, you may swim in bodies of water fed by runoff from hydrothermal features. An established spot is the "Boiling River" two miles north of Mammoth on the North Entrance Road. It is open only during daylight hours and is closed during times of high water.

What can we do at Mammoth during the winter?
You can take self-guided tours of Fort Yellowstone and the Mammoth Terraces, join a guided walk or tour, cross-country ski, snowshoe, ice skate (sometimes), rent a hot tub, soak in the Boiling River, watch wildlife, attend ranger programs, and visit the Albright Visitor Center. You can also drive the Northeast Entrance road through to Cooke City, Montana; coyotes, bison, elk, wolves, eagles, and other wildlife are often seen.

Approximately 8 miles east of Mammoth, on the northeast entrance road, you can walk a self-guiding, fully accessible boardwalk trail, The Forces of the Northern Range.

Formation

Even though Mammoth Hot Springs lies outside the caldera boundary, the hydrothermal activity here is probably the result of the same magmatic system that fuels other Yellowstone hydrothermal areas. One idea is that a basalt body beneath Mammoth is heating the sources of underground water. Another idea is that hot water flows from Norris to Mammoth along a fault zone that lies roughly along the Norris to Mammoth road. Shallow circulation along this corridor allows Norris's super-heated water to cool somewhat to about 170°F before surfacing at Mammoth.

While most of the hydrothermal formations you see in the park are comprised of siliceous sinter and geyserite, the hot spring terraces here formed of travertine, a kind of calcium carbonate. Hydrothermal waters rise through the limestone underlying this area, carrying high amounts of dissolved carbonate. When the mineral-rich water reaches the surface, it cools and its pressure decreases, gases are released, and the calcium carbonate is deposited as travertine, the chalky white rock of the terraces. Due to rapid deposition, these features change quickly and constantly, but the overall volume of discharged water fluctuates little.

Mammoth shows evidence of thousands of years of hydrothermal activity. Terrace Mountain has a thick cap of travertine estimated to be 400,000 years old. The Mammoth Terraces range from 57,000–7,000 years old. They extend from the hillside where we see them today, across the Parade Ground, and down to Boiling River. An old terrace formation, known as Hotel Terrace, underlies all of Fort Yellowstone and the Mammoth Hotel. Several large sink holes, which are fenced on the Parade Ground, provide visual evidence of the area's hollow foundation.

The Mammoth area also exhibits evidence of glacial activity. Glacial till from the Pinedale Glaciation (14,000 years ago) is found on the summit of Terrace Mountain. Thermal kames, including Capitol Hill and Dude Hill, are major features of the Mammoth area. East of Mammoth, streams at the edge of glaciers formed the small, narrow valleys where

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Mammoth Hot Springs

Floating Island Lake and Phantom Lake are found. In Gardner Canyon, the old bed of the Gardner River is covered by glacial till.

Wildlife

Mammoth is lower in elevation than most of the rest of the park, and has always been used by elk in winter. Now elk are found in the area year-round. The development offers elk an ample supply of forage and usually provides refuge from most of their natural predators. (However, wolves have killed a few elk in the developed area.) Rivaling the elk in numbers, Uinta ground squirrels form large colonies every summer in front of the visitor center and among the hotel cabins.

Elk are found in Mammoth year-round, and can be especially dangerous during the autumn rut.

45th Parallel Bridge & Boiling River

On the road from Mammoth to Gardiner, a sign marks the 45th parallel of latitude, which is an imaginary line circling the globe halfway between the Equator and the North Pole. This same line passes through Minneapolis–St. Paul; Ottawa, Ontario, Canada; Bordeaux, France; Venice, Italy; Belgrade, Yugoslavia; and the northern tip of the Japanese islands. Here it also marks the Montana–Wyoming border.

A parking area on the east side of the road is used by people walking to one of the few legal thermal soaking areas in the park. Upstream about a half mile, a large hot spring, known as Boiling River, enters the Gardner River. Soaking is allowed during **daylight hours only** and at your own risk. Bathing suits are required and no alcoholic beverages are allowed. Thermal waters can harbor organisms that cause a fatal meningitis infection and Legionnaires' disease. Exposing your head to thermal water by immersion, splashing, touching your face, or inhaling steam increases the risk of infection. Boiling River is closed during hazardous high water.

Mt. Everts

Mt. Everts, 7,841 feet high, is the long ridge northeast of Mammoth. It is made up of distinctly layered sandstones and shales—sedimentary rocks deposited when this area was covered by a shallow inland sea, 70–140 million years ago. Fossils have been found here *(see Chapter 3).* Its steep cliffs are habitat for bighorn sheep, which sometimes can be seen in Gardner Canyon.

Mt. Everts was named for explorer Truman Everts, a member of the 1870 Washburn Expedition who became separated from the group and spent the next 37 days starving, freezing, and hallucinating as he made his way through the wilderness. Everts never made it as far as Mt. Everts. He was found near what is now the Blacktail Plateau Drive and was mistaken for a black bear and nearly shot. His story remains Yellowstone's best known, lost-in-the-wilderness story.

Collecting rocks, fossils, or anything else is forbidden on Mt. Everts and throughout the park.

Bunsen Peak

Bunsen Peak is 8,564 feet high and has two popular trails, described on the next page. It is an intrusion of igneous material (magma) that formed during the same period as the Absaroka volcanics *(see Chapter 3).* The peak burned in 1886 and in 1988. Old photos show the creep of trees up Bunsen following the 1886 fires; new patterns of open space were created by the fires of 1988.

Bunsen Peak and the "Bunsen burner" were both named for the German physicist, Robert Wilhelm Bunsen. His students gave the burner that name because he was involved in pioneering research about geysers, and a "Bunsen burner" has a resemblance to a geyser. His theory on geysers was published in the 1800s, and it is still believed to be accurate.

Swan Lake Flat

South of Bunsen Peak is Swan Lake Flat, a large glaciated area now made up of meadows where visitors often see elk, bison, and sometimes grizzlies and wolves. It is also excellent for watching cranes, ducks, and other birds.

Obsidian Cliff

Obsidian Cliff, 11 miles south of Mammoth Hot Springs, rises 150 to 200 feet above Obsidian Creek. Obsidian, or "volcanic glass," forms when rhyolitic lava cools very quickly, forming natural glass. The Obsidian Cliff rhyolite flow is dated at 183,000 years old. Forty rhyolite flows in the park contain obsidian, but only a few contain obsidian of tool quality. A massive outcrop the size of Obsidian Cliff is rare because obsidian is usually found as small sections of other rock outcrops.

Obsidian was important to native peoples. For centuries Native Americans made projectile points and other tools from obsidian, which fractures into round pieces with sharp edges. Because there are so few sources of obsidian, it was a valuable trade item and is found throughout the continent, far from its source. (Obsidian begins to absorb moisture once it is exposed to the air. By measuring the amount of moisture that has been absorbed, obsidian can be dated, and its source can be located.)

In 1996, Obsidian Cliff was named a National Historic Landmark. The historic wayside exhibit structure here is one of the first of its kind in Yellowstone, built in the 1920s.

The Obsidian Cliff area is closed to hiking, collecting, and all entry to protect the resource.

DAY HIKES

Beaver Ponds: Moderately strenuous; 5 miles round trip. Climbs 350 feet up Clematis Gulch, then through sagebrush meadows and stands of aspen to a series of beaver ponds. Look for elk, mule deer, pronghorn, moose, beaver dams and lodges, the occasional beaver, and waterfowl. Be alert for bears: both black and grizzly bears forage in this area. Past the ponds, the trail travels through forest and grassland back to Mammoth. Trailheads: between Liberty Cap and the stone house (the Judge's house) next to the Mammoth Terraces or behind the end of the guest wing of the hotel.

Bunsen Peak: Moderately strenuous; 4.2 miles round trip. Climbs 1,300 feet through forest and meadow to the summit of Bunsen Peak, which has panoramic views of the Blacktail Plateau, Swan Lake Flat, Gallatin Mountain Range, and the Yellowstone River Valley. Return by the same route. Trailhead: 5 miles south of Mammoth on the Mammoth–Norris Road.

Osprey Falls: Strenuous; 8 miles round trip. Follows Bunsen Peak Road (hiking/biking only) through grassland and burnt forest 2½ miles to Osprey Falls Trail (no bikes allowed), which descends switchbacks to the bottom of Sheepeater Canyon, one of the deepest canyons in Yellowstone. Trailhead: 5 miles south of Mammoth on the Mammoth–Norris Road.

Lava Creek: Moderately strenuous; 3½ miles one way. Follows Lava Creek downstream past Undine Falls (60 feet), descending gradually, passes the confluence of the creek and Gardner River, and crosses the river on a footbridge to a final climb out. Trailhead: Lava Creek picnic area on Mammoth–Tower Road; ends in a pullout north of Mammoth Campground on the North Entrance Road.

Rescue Creek: Moderately strenuous; 8 miles one way. Follows Blacktail Deer Creek Trail past the east end of Blacktail Pond then climbs up short hill, then veers left on the Rescue Creek Trail. Climbs gradually through aspens and meadows, then descends through forests to open sagebrush flats that lead to a footbridge across the Gardner River. Trailhead: 7 miles east of Mammoth on Mammoth–Tower Road; ends 1 mile south of the North Entrance Station

Sepulcher Mountain: Strenuous; 11 miles round trip. Follows the Beaver Ponds Trail *(see above)* to the Sepulcher Mountain Trail junction, then climbs 3,400 feet through forest and meadows to the 9,652 foot summit. Loop trail continues along the opposite side of the mountain through an open slope to the junction of Snow Pass Trail, which descends to the Howard Eaton Trail, which should be followed north to Mammoth Terraces and the trailhead. Trailhead: between Liberty Cap and the stone house (the Judge's house) next to the Mammoth Terraces.

Wraith Falls: Easy; 1 mile round trip. Travels open sagebrush and Douglas-fir forest to the foot of Wraith Falls cascade on Lupine Creek. Trailhead: pullout ¼ mile east of Lava Creek Picnic area on the Mammoth–Tower Road.

Blacktail Deer Creek–Yellowstone River: Moderately strenuous; 12 miles one way. Follows Blacktail Deer Creek as it descends 1,100 feet through rolling, grassy hills and Douglas-fir forest to the Yellowstone River. Crosses steel suspension bridge spanning Yellowstone River then joins the Yellowstone River Trail, which continues downriver, passing Knowles Falls and into arid terrain until it ends in Gardiner, Montana. **Caution:** Very narrow, short stretch near Gardiner is slippery when wet. Trailhead: 7 miles east of Mammoth on Mammoth–Tower Road; ends in Gardiner, Montana.

Historic Structures & Areas

Mammoth Hot Springs Historic District—includes Albright Visitor Center

Fort Yellowstone Historic Landmark District

Obsidian Cliff National Historic Landmark

Obsidian Cliff Kiosk

U.S. Post Office

See Chapters 1 and 8 for more information on historic areas in the park.

Also located in this area:

Administrative Headquarters of Yellowstone National Park

Yellowstone Heritage Center (opening this fall), in Gardiner, MT; houses the Yellowstone Research Library and Archives, open to the public.

10

Major Areas: Norris

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When does Echinus Geyser erupt?
Once very predictable, Echinus's eruptions now vary from 1 to 9 hours. Even so, an eruption is worth the wait. Go down to the viewing area and look to see if the pool is full and overflowing. If it is, an eruption is likely within twenty minutes.

When will Steamboat Geyser erupt?
Steamboat's eruptions are entirely unpredictable and often many years apart. However, it has erupted six times since May 2000—including March, April, and October 2003.

Full eruptions of the world's tallest active geyser are spectacular. The water column shoots twice as tall as the trees and drenches everything. A steam phase continues for approximately 24 hours. Even its frequent "minor phase" eruptions eject water 10 to 40 feet high.

Why is this place so colorful?
The colors here, like in other hydrothermal areas, are due to combinations of minerals and lifeforms resistant to acidity and heat. Silica or clay minerals saturate some acidic waters, making them appear milky. Iron oxides, arsenic, and cyanobacteria create the red-orange colors. *Cyanidium* grows bright green. Mats of *Zygogonium* are dark purple to black on the surface where they are exposed to the sun, bright green beneath. Sulphur creates a pale yellow hue.

The new hydrothermal area that developed in 2003 at Nymph Lake, north of Norris Geyser Basin

Constant Geyser in Porcelain Basin

Norris Geyser Basin

Norris Geyser Basin is the hottest, oldest, and most dynamic of Yellowstone's hydrothermal areas. The highest temperature yet recorded in any Yellowstone hydrothermal area was measured in a scientific drill hole at Norris: 459°F just 1,087 feet below the surface. Norris shows evidence of having had hydrothermal features for at least 115,000 years. The features in the basin change daily, with frequent disturbances from seismic activity and water fluctuations.

Activity in Norris's Back Basin increased dramatically in mid 2003. Because of high ground temperatures and new features beside the trail, much of Back Basin was closed until October. A small portion is still closed as of March 2004.

Norris is so hot and dynamic primarily because it sits on the intersection of three major faults. One runs from Norris north through Mammoth to the Gardiner, Montana, area. The Hebgen Lake fault runs from northwest of West Yellowstone, Montana, to Norris. These two faults intersect with a ring fracture from the Yellowstone Caldera eruption 640,000 years ago.

Features

Norris Geyser Basin consists of three main areas: Porcelain Basin, Back Basin, and One

Updates

Hundred Spring Plain. Most of the water here is acidic, and Norris has rare acidic geysers such as Echinus (pH 3.5 or so). Echinus is found in Back Basin, a wooded area with features scattered along a 1½ mile trail of boardwalk and dirt. Steamboat Geyser, the tallest active geyser in the world (300 to 400 feet) steams on the hillside between Back Basin and the Norris Museum. On the other side of the museum, Porcelain Basin provides a sensory experience in sound, color, and smell along its half-mile dirt, asphalt, and boardwalk trail. One Hundred Spring Plain is an off-trail section that is very acidic, hollow, and dangerous. Travel is discouraged without the guidance of knowledgeable staff.

Periodically, Norris Geyser Basin undergoes a large-scale basin-wide disturbance that may last a few weeks. Water levels fluctuate, temperatures and pH change, color changes, and eruptive patterns change throughout the basin. During a disturbance in 1985, Porkchop Geyser became a continuous jet of steam and water; during a disturbance in 1989, Porkchop apparently clogged with silica and blew up, throwing rocks more than 200 feet. It erupted on July 16, 2003, the first time since 1991 and a harbinger of the increased activity that summer.

Geologists and chemists who have studied these disturbances have several theories about why they occur. They may be caused by a massive fluctuation in the underground reservoirs providing water to the basin. In the fall, they could be caused by less surface water mixing with water from deep underground, which holds more silica and clogs the cracks and crevices that supply water, thereby creating a "disturbance" as pressure builds.

The Ragged Hills that lie between Back Basin and One Hundred Spring Plain are thermally altered kames formed as glaciers receded. The underlying hydrothermal features melted remnants of ice and caused masses of debris to be dumped. These debris piles were then altered by steam and hot water flowing through them.

History

The area was named for Philetus W. Norris, the second superintendent of Yellowstone, who provided early detailed information about the hydrothermal features. Two historic buildings remain in this area: The Norris Geyser Basin Museum *(see Chapter 8)* and the Museum of the National Park Ranger, which is housed in the Norris Soldier Station, one of the only remaining soldier stations in the park *(photo below).* The building was used as a ranger station and residence until the 1959 Hebgen Lake earthquake caused structural damage. The building was restored in 1991 and adapted to its current use.

The Museum of the National Park Ranger, housed in the historic Norris Soldier Station, is staffed by volunteers, most of whom are retired National Park Service employees.

Wildlife

The meadows adjacent to the Gibbon and Madison rivers are prime elk calving areas in the spring. Fall brings bull elk looking for females to mate with. Bison frequent the same meadows in the spring, summer, and fall and use the hydrothermal areas in the winter. Both black and grizzly bears pass through the Norris area. Grizzlies feed on carcasses of elk and bison that died in the hydrothermal areas during the winter.

Norris is one of the few areas in the park having lizards. The sagebrush lizard can survive here due to the influence of hydrothermal activity. Chorus frogs may be heard in the area in the spring *(see Chapter 7 for more about these animals).*

Killdeer are found in the basin year-round taking advantage of the brine flies and other insects that live in the warm waters.

Thermophiles

Because Norris is acidic, some forms of life especially suited to life in extremes of heat and acid have been found here. *Cyanidium* is one of the more unusual algae found here; look for the brilliant green streak near Whirligig Geyser. Elements such as arsenic also color the features. *See also Chapter 4.*

10

Norris

Historic Structures & Areas

Norris Soldier Station (now the Museum of the National Park Ranger)

Norris Geyser Basin Museum

See Chapters 1 and 8 for more information on historic areas in the park.

Roaring Mountain

North of Norris, Roaring Mountain is a large, acidic hydrothermal area (solfatara) with many fumaroles. In the late 1800s and early 1900s, the number, size, and power of the fumaroles was much greater than today. The fumaroles are most easily seen in the cooler, low-light conditions of morning and evening.

Virginia Cascades

A one-way, three-mile section of an older portion of the Grand Loop Road takes visitors past 60-foot high Virginia Cascades. The waterfall is formed by the Gibbon River as it crosses part of the rim of the Yellowstone Caldera. Lava flows formed the cliffs alongside the road.

On the main road east of the drive's entrance, a boardwalk takes visitors among lodgepole pines blown down by wind-shear in 1984. They are part of a 22-mile swath of forest flattened by this weather event. Four years later, they burned during the 1988 fires. The once blackened and barren landscape is now sprinkled with young lodgepoles.

Artists' Paint Pots

Artists' Paint Pots is a small but lovely hydrothermal area south of Norris Junction. A one-mile round trip trail takes visitors through a section of forest burned in 1988 to colorful hot springs and two large mudpots.

Monument Geyser Basin

This small basin may contain clues to recent discoveries under Yellowstone Lake. While the basin has no active geysers, its "monuments" are siliceous sinter deposits similar to the siliceous spires discovered on the floor of the lake. Scientists hypothesize that this basin's structures formed from a hot water system in a glacially dammed lake during the waning stages of the Pinedale Glaciation *(see Chapter 3)*. The basin is on a ridge reached by a very steep 1-mile trail just south of Artists' Paint Pots. **Caution:** Active hydrothermal features and thin crust; do not travel beyond the end of the trail or in the geyser basin.

DAY HIKES

Grizzly Lake: Moderately strenuous; 4 miles round trip. Passes through a lodgepole pine stand burned in 1976 and 1988, and through meadows to the long, narrow lake. Can be wet and mosquito laden before July. Trailhead: 1 mile south of Beaver Lake on Mammoth–Norris Road.

Solfatara Creek: Easy; 6.5 miles one way. Requires a car shuttle or returning the same route. Follows Solfatara Creek and soon passes the junction with the Howard Eaton (to Ice Lake, Wolf Lake, etc.). It parallels a power line for most of the way to Whiterock Springs; then climbs a short distance to Lake of the Woods (look off trail) and passes Amphitheater Springs and Lemonade Creek—small, but pretty hydrothermal areas. Trail continues to the Mammoth–Norris Road. **Caution:** Check at a visitor center for trail closures due to bear activity. Trailhead: Loop C of Norris Campground; ends ¾ miles south of Beaver Lake Picnic Area.

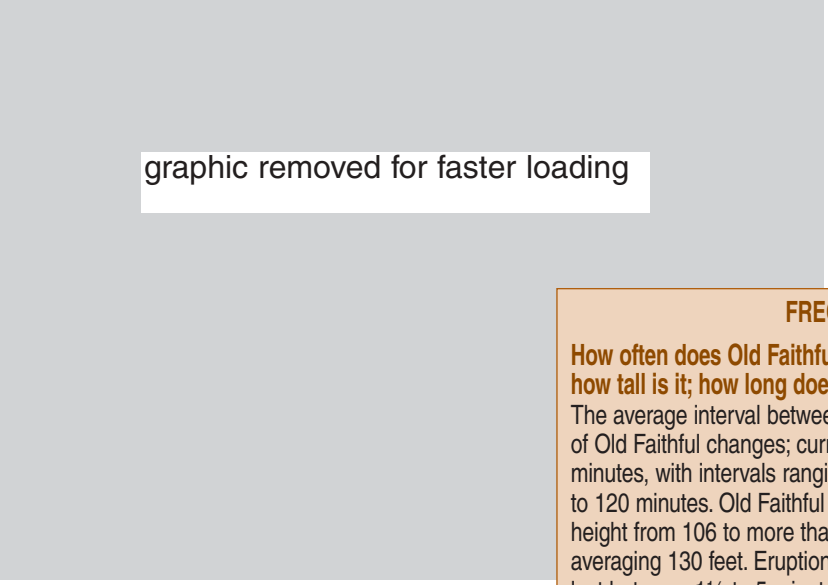
Ice Lake (direct route): Easy; 0.3 miles. Travels through lodgepole forest to Ice Lake, a small lake with a wheelchair accessible backcountry site. Hikers can continue on the Howard Eaton trail to Wolf Lake, Grebe Lake, Cascade Lake, and on to Canyon. *(See Canyon Area for descriptions.)* Trailhead: 3½ miles east of Norris on Norris–Canyon Road.

Wolf Lake Cut-off: easy; 6 miles round trip. Follows the Gibbon River past Little Gibbon Falls and through dense, partially burned lodgepole pine forest to Wolf Lake. Trail crosses the stream several times (no bridges) and is not regularly maintained. Trailhead: big pullout about ¼ mile east of Ice Lake Trailhead on Norris–Canyon Road.

Cygnet Lakes: Easy; 8 miles round trip. Travels through intermittently burned lodgepole pine forest and past ephemeral ponds to lush meadows surrounding the small and boggy Cygnet Lakes. Trail continues, but is not maintained. **Caution:** Due to bear activity, trail is day-use only. Trailhead: pullout on south side of Norris–Canyon road approximately seven miles from Norris Junction.

Artists' Paint Pots: Easy, with one steep uphill climb to the upper loop; 1 mile round trip. Passes through partially burned lodgepole forest and by a wet meadow then through to colorful hot springs, small geysers, and two large mudpots. Trailhead: 2½ miles south of Norris on Norris–Madison Road.

Monument Geyser Basin: Strenuous; 2 miles round trip. Follows the Gibbon River, then turns sharply uphill and climbs 500 feet in one-half mile. Watch your footing; rocks are loose. *See description of geyser basin above.* **Caution:** Active thermal features and thin crust here; do not travel beyond the end of the trail or within the geyser basin. Trailhead: 5 miles south of Norris just past Gibbon River Bridge.



Old Faithful as seen from Observation Point

FREQUENTLY ASKED QUESTIONS

How often does Old Faithful erupt; how tall is it; how long does it last?
The average interval between eruptions of Old Faithful changes; currently it is 92 minutes, with intervals ranging from 45 to 120 minutes. Old Faithful can vary in height from 106 to more than 180 feet, averaging 130 feet. Eruptions normally last between 1½ to 5 minutes and expel from 3,700 to 8,400 gallons of water. At the vent, water is 204°F (95.6°C).

Is Old Faithful as "faithful" as it has always been?
Since its formal discovery in 1870, Old Faithful has been one of the more predictable geysers. However, like all geysers, Old Faithful is constantly changing and evolving due to ongoing processes within its "plumbing" and from earthquakes (see "Old Faithful," below). Even so, Old Faithful remains one of the more predictable geysers.
See also the hydrothermal questions in the Introduction, and Chapter 3, Geology.

The Upper Geyser Basin

Yellowstone National Park has approximately half of the world's geysers—most of them in this area. One square mile contains at least 150 of these hydrothermal wonders. Five major geysers—Old Faithful, Castle, Grand, Daisy, and Riverside—are predicted regularly by the interpretive ranger staff. This basin contains many frequent, smaller geysers, and numerous hot springs

The hills surrounding Old Faithful and the Upper Geyser Basin are composed of rhyolite lava flows. These flows, occurring long after the catastrophic caldera eruption of 640,000 years ago, flowed across the landscape like stiff mounds of bread dough due to their high silica content.

During the glacial periods 20,000–15,000 years ago, scientists estimate hydrothermal activity occurred in the Upper Geyser Basin. The glacial till deposits underlying this and other area geyser basins provide the storage area for the water necessary for geysers to occur. Many landforms, such as the Porcupine Hills north of Fountain Flats, are comprised of glacial gravel.

The Firehole River

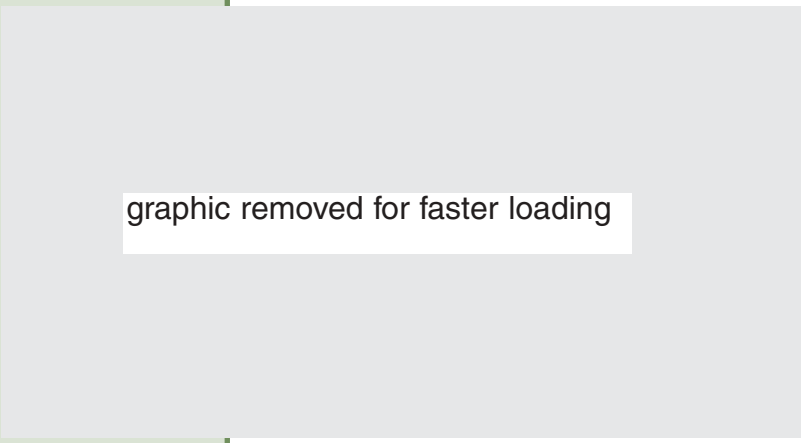
The Firehole River originates from cold springs on the Madison Plateau and plunges over the 125–foot Kepler Cascades before reaching the Upper Geyser Basin. The river flows through three major geyser basins—Upper, Midway, and Lower—before joining the Gibbon River at Madison Junction to form the Madison River.

The epicenter of the 1959 Hebgen Lake Earthquake was located west of the park near the Madison River. This earthquake, measured at 7.5 on the Richter scale, shook up the geothermal underpinnings of the geyser basins along the Firehole River. Hundreds of geysers erupted—including hot springs never known to erupt. This hyper-activity continued for months.

Old Faithful Geyser

Predicting any geyser's eruption is difficult because of the complex interactions of constantly changing factors. Old Faithful has been analyzed for years by mathematicians, statisticians, and dedicated observers. We now know a direct relationship exists between the duration of Old Faithful's eruption and the length of the following interval. During a short eruption, less water and heat are discharged; thus, they rebuild again in a short time. Longer eruptions mean more water and heat are discharged and they require more time to rebuild.

Over time, the average interval between Old Faithful's eruptions increases, in part due to ongoing processes within its plumbing. Changes also result from earthquakes. Prior to the Hebgen Lake Earthquake, the interval between Old Faithful's eruptions averaged more than one hour. Its intervals increased after that earthquake and again after the 1983 Borah Peak Earthquake, centered in Idaho. In 1998, an earthquake near Old Faithful lengthened the interval again; an earthquake swarm further increased intervals. As of March 2004, the average interval was 92 minutes. Intervals of approximately 65 minutes follow eruptions of 2.5 minutes or less.



Fountain Paint Pot, Lower Geyser Basin

Wildlife

Hydrothermal basins provide important habitat for wildlife in the Old Faithful area. Large numbers of bison and elk live here year-round. In the winter, they take advantage of the warm ground and thin snow cover. During spring and fall, moose are sometimes seen during the early morning or late afternoon. Both black and grizzly bears are seen, especially during the spring when winter-killed carcasses are available. Yellow-bellied marmots are frequently seen in the rocks behind Grand Geyser and near Riverside Geyser. Thermophiles live in the runoff channels of hot springs and geysers, providing food for tiny black ephydrid flies. The flies, in turn, lay their eggs in salmon colored clumps just above the water surface where they are then preyed upon by spiders. Killdeer also feast on the adult flies.

Midway Geyser Basin

This geyser basin, across the Firehole River from the Grand Loop Road, is smaller in size than the Upper and Lower geyser basins. Excelsior Geyser is a gaping crater 200 x 300 feet that constantly discharges more than 4,000 gallons of water per minute into the river. Grand Prismatic Spring, Yellowstone's largest hot spring, is 370 feet in diameter and more than 121 feet in depth. A bridge across the Firehole River allows access to the basin.

Lower Geyser Basin

Activity of the Lower Geyser Basin can be viewed from two areas: Fountain Paint Pot *(shown at left, and described on next page)* and Firehole Lake Drive. The latter is a 2-mile, one-way drive where you will find the Great Fountain, the sixth geyser predicted by the Old Faithful staff in summer. Its eruptions send jets of water droplets bursting 100 to 200 feet in the air, while waves of water cascade down its sinter terraces.

Hydrothermal features extend throughout this area, including sites that researchers explore for thermophiles that might be useful in medicine and science. *For more on bio-prospecting, see Chapter 9.*

Fountain Flats Drive, a short side road immediately south of the Nez Perce picnic area, follows the Firehole River for 1½ miles to a trailhead. A hiking and biking trail continues along the old roadbed allowing access to the Sentinel Meadow and Fairy Falls trails *(see descriptions next page).* Also along this path is a wheelchair-accessible backcountry site at Goose Lake.

WALKING THE GEYSER BASINS

After viewing Old Faithful, visitors can spend an hour or all day exploring the area from the safety of these established walkways.

Upper Geyser Basin Area

Numerous loops or one-way walks explore the Upper Geyser Basin; a few descriptions follow. Geysers such as Castle, Grand, Riverside, and Daisy plus Morning Glory Pool, Biscuit Basin, and Black Sand Basin can be reached by other trails described in *The Old Faithful Area Trail Guide,* available at trailheads and the visitor center. Obtain geyser prediction times at the visitor center.

Geyser Hill Loop

Boardwalks, foot paths; interpretive signs. Easy, 1⅓ mile round trip. Passes by Old Faithful, crosses the Firehole River, and then circles Geyser Hill where ten geysers erupt frequently, along with other geysers and hot springs. Trailhead: Old Faithful Visitor Center.

Observation Point Loop

Foot path.
Strenuous; 1.1 miles round trip. Climbs about 150 feet to an overlook of the Upper Geyser Basin. Trailhead: just past the footbridge behind Old Faithful Geyser.

Midway Geyser Basin

Boardwalk; interpretive signs.
Easy; half mile. Boardwalk loops by impressive features such as Excelsior Geyser and Grand Prismatic Spring. Trailhead: 6 miles north of the Old Faithful area.

Fountain Paint Pot

Easy; less than half mile. Boardwalk loops past Yellowstone's four types of hydrothermal features: geysers, hot springs, mudpots, and fumaroles. Trailhead: 8 miles north of the Old Faithful area.

DAY HIKES

Visit backcountry lakes and hydrothermal features on these day hikes. ***Caution:*** *In hydrothermal areas, stay on the established trails for your safety and to protect fragile features.*

Upper Geyser Basin Area

Mallard Lake: Moderately strenuous; 6.8 miles round trip. Climbs through lodgepole forest and along meadows and rocky slopes to Mallard Lake. Trailhead: southeast side of the Old Faithful Lodge cabins, near the Firehole River.

Lone Star Geyser: Easy; 5 miles round trip. Open to bicycles. Follows old service road along the Firehole River through lodgepole forests to the geyser, which erupts approximately every 3 hours. Visitors record geyser times and observations in a logbook located in a box near the geyser. Trailhead: 3 miles south of the Old Faithful area, just beyond Kepler Cascades parking area.

Mystic Falls: moderately strenuous; 2½ miles round trip. Follows a lovely creek through a lodgepole forest to the 70-foot falls. Turn around here or climb the switchbacks to an overlook of the Upper Geyser Basin, then loop back to the main trail. Trailhead: back of the Biscuit Basin boardwalk.

Midway and Lower Geyser Basin Area

Fairy Falls: Easy; 5 or 7 miles round trip. Two trails lead to this 200-foot waterfall. The shorter route approaches from the south, crossing the Firehole River then following the hiking/biking road approximately 1 mile to the Fairy Falls Trail. The longer route approaches from the north along hiking/biking road 1¾ miles to the Fairy Falls Trail. Trailheads: short route—1 mile south of Midway Geyser Basin; long route—at the end of Fountain Flat Drive, north of Fountain Paint Pot.

Sentinel Meadows: Moderate; 3 miles round trip (4 if you go to Queen's Laundry). Trail follows the Firehole River a short distance, then veers away from the river toward the meadows. Look for the large mounds of hot springs and for the remains of the old, incomplete bathhouse at Queen's Laundry, 1.9 mi from the trailhead. Begun in 1881, construction was abandoned as park administrations and priorities changed. Minerals from the hot springs preserved the structure, which was the first building constructed by the government for public use in any national park. Queen's Laundry is a National Historic Site. Trail is very wet in the spring and very buggy in the summer. Trailhead: 10 miles north of Old Faithful, at the end of Fountain Flat Drive—cross the footbridge over the Firehole River to the trailhead.

Historic Structures & Areas

Nez Perce National Historic Trail passes through the Lower Geyser Basin

Old Faithful Inn 100 years old in 2004

Old Faithful Historic District; including Old Faithful Lodge

F. Jay Haynes photo studio, built in 1897; originally in front of the Old Faithful Inn, now near the crosswalk at the Grand Loop Road.

The Klamer Store, also built in 1897, is the general store north of the Old Faithful Inn.

Queen's Laundry, begun in 1881 but never finished, in Sentinel Meadows (see trail description at left).

See Chapters 1 and 8 for more information on historic areas in the park.

10

Major Areas: Tower–Roosevelt

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Basalt columns near Tower Fall

FREQUENTLY ASKED QUESTIONS

How tall is Tower Fall?
132 feet.

How did the rock columns form in the canyon?
The formation you see across the Yellowstone River was formed by a basaltic lava flow that cracked into hexagonal columns as it slowly cooled. You can see other basalt columns at Sheepeater Cliff along the Gardner River between Mammoth and Norris.

How long is the trail to the bottom of Tower Fall?
One mile round trip from the Tower Fall Overlook to the bottom. The trail is steep—it descends about 300 feet in one-half mile. If you have heart, lung, or knee problems, you may want to enjoy the view from the overlook.

How did the petrified tree become petrified?
Two elements are required:
1. Rapid burial to minimize decay. In Yellowstone, trees were buried by volcanic deposits and mudflows 45–50 million years ago.
2. Groundwater with high concentrations of silica. The silica precipitates from ground water, filling the spaces within wood cells, and petrifies the tree.

Erosion uncovered the tree. In Yellowstone, glacial ice, running water, and wind have uncovered vast areas of petrified trees.

Revised

Formation

The geology of the Tower area and its landforms are expressions of geologic events that helped shape much of the Yellowstone area. Mount Washburn and the Absaroka Range are both remnants of ancient volcanic events that formed the highest peaks in this area. Ancient eruptions 45 to 55 million years ago buried the trees of Specimen Ridge in ash and debris flows. The oldest basalt is the Junction Butte basalt, 2.2 million years old, which is exposed along the road north of Tower Fall. Across the Yellowstone River in this area (called the Narrows), the lower basalt is 1.5–2.2 million years old; the upper basalt is 1.2 million years old. The sediments between these basalts may show evidence of the oldest known glaciation in Yellowstone. Glacial boulders from the last major glaciation of Yellowstone—the Pinedale—rest on top of the youngest basalt.

Glaciers also scoured the landscape, exposing the petrified trees and leaving evidence of their passage throughout the area. The glacial ponds and huge boulders (erratics) between the Lamar and Yellowstone rivers were left by the retreating glaciers, as were several moraines.

See Chapter 3 for more about Yellowstone's geology.

Lamar Canyon

This canyon, east of Tower Junction, contains outcrops of granite and granitic gneiss that are among the oldest rocks known in the park—more than two billion years old. Little is known about their origin; time, heat and pressure have altered these rocks and obscured their early history. Only in the Gallatin Range are older outcrops found inside the park.

Tower Fall

Tower Creek drops 132 feet at Tower Fall, which is framed by eroded volcanic pinnacles. The idyllic setting at the base of the falls has inspired numerous artists, including Thomas Moran.

Calcite Springs

These hydrothermal springs, located on a slope near river level, mark the downstream end of the Grand Canyon of the Yellowstone River. The heat driving these springs rises from a volcanic fracture zone beneath the area. Deposits of oil and other hydrocarbons exist in rocks beneath the springs; heat forces oil out of the deeper rocks to the surface.

Specimen Ridge

Many layers of petrified trees exist on Specimen Ridge. Located at the top of the ridge along the Northeast Entrance Road east of Tower Junction, the area also includes excellent samples of petrified leaf impressions, conifer needles, and microscopic pollen from numerous species no longer growing in the park. The Petrified Tree, west of Tower Junction, is an excellent example of an ancient redwood, similar to many found on

Specimen Ridge, that is more accessible to park visitors.

Wildlife

The (relatively) low-elevation valleys of the this area provide critical winter range to some of the largest wild herds of bison and elk found in North America. Due to the large herds of wintering bison and elk, the Lamar Valley was chosen as a primary site for restoration of gray wolves into Yellowstone in 1995 (see Chapters 7 and 9). Historic accounts indicate that wolves inhabited nearly all portions of this area. Multiple wolf pack territories currently exist here. Coyotes are also common, and an occasional bobcat, cougar, or red fox is reported.

The gorge and cliffs provide habitat for wildlife species such as bighorn sheep, osprey, peregrine falcons, and red-tailed hawks.

Both grizzly and black bears are sighted throughout the area, particularly in the spring. Black bears are more commonly seen around Tower Fall and Tower Junction. Grizzlies are frequently seen on the north slopes of Mt. Washburn, particularly in the spring when elk are calving. Road pullouts provide excellent places from which to watch wildlife.

DAY HIKES

Lost Lake: moderate; 4 miles round trip. Climbs 300 feet then joins the Roosevelt horse trail and continues west to Lost Lake. From Lost Lake, the trail follows the contour around the hillside to the Petrified Tree parking area, crosses the parking lot and continues up the hill, loops behind the Tower Ranger Station, across the creek, and back to the lodge. **Caution:** If you meet horses, move to the downhill side of the trail and remain still. Trailhead: behind Roosevelt Lodge.

Garnet Hill Loop: moderate; 7½ miles round trip. Trail follows the stagecoach road about 1½ miles to the cookout shelter, then follows Elk Creek almost to the Yellowstone River then turns upriver around Garnet Hill and back to the Northeast Entrance Road. Trailhead: park in the large parking area east of the service station at Tower Junction, then walk approximately 100 yards on the Northeast Entrance Road to the trailhead on the left.

Hellroaring: Strenuous; 4 miles round trip. The trail begins with a steep descent to Yellowstone River Suspension Bridge, then crosses a sagebrush plateau and drops down to Hellroaring Creek. The Yellowstone River and Hellroaring Creek are both popular fishing areas. **Caution:** This trail can be hot and dry during the summer months so take plenty of water. Watch your footing if you go off trail and onto the smooth river boulders along the Yellowstone River. You can also access this trail from Tower Junction by following the Garnet Hill Loop Trail (see above); roundtrip distance is 10 miles. Trailhead: Hellroaring parking area 3½ miles west of Tower Junction.

Yellowstone River Picnic Area: moderate; 3.7 miles round trip. Climbs steeply for a short distance, then follows the rim of the Grand Canyon of the Yellowstone upriver, with views of the Narrows of the Yellowstone, the Overhanging Cliff area, the towers of Tower Fall, basalt columns, and the historic Bannock Ford. Watch your footing and beware of steep dropoffs into the canyon. Do not approach bighorn sheep; retreat or walk around them, keeping at least 25 yards between you and the animals. Above Bannock Ford, trail connects with the Specimen Ridge Trail and follows it a short distance to a left turn back to the Northeast Entrance Road. Once at the road, walk west 0.7 miles back to the picnic area. Trailhead: Yellowstone River Picnic Area.

Slough Creek: Moderately strenuous; 4 or 10 miles round trip. Actually a long-distance trail that leads into the Absaroka-Beartooth wilderness beyond Yellowstone, this trail is often used by anglers and hikers up to the first and second meadows. Trail follows historic wagon trail up Slough Creek, beginning with a climb up a moderately steep hill then down to the first meadow (2 miles); continues along the edge of the meadow to the second meadow (5 miles from trailhead.) Horse-drawn wagons also use this trail, they come from Silver Tip Ranch, a private ranch north of the park boundary that has a historic right of access. **Caution:** Be alert for bears; they frequent these meadows. Trailhead: On the road to Slough Creek Campground; where the road bears left, park beside the vault toilet.

Mt. Washburn: Moderately strenuous; 3 miles one way. Two trails lead to the summit of Mt. Washburn; both are popular and often crowded in the summer. The north approach follows a service road and is open to bicycles and service vehicles. The south approach is hiking only. For descriptions of this area, see the Canyon area. Trailhead for north approach: Chittenden Road parking area, 8.7 miles south of Tower Junction.

The road from Chittenden Road south to Canyon Junction, including Dunraven Pass, is closed because of road work.

Historic Structures & Areas

Lamar Buffalo Ranch

Northeast Entrance Station

Roosevelt Lodge Historic District

See Chapters 1 and 8 for more information on historic areas in the park.

10

Major Areas: West Thumb & Grant

FREQUENTLY ASKED QUESTIONS

Why is this area called West Thumb?
The name "West Thumb" comes from Yellowstone Lake's resemblance to the shape of a human hand; the large southwestern bay represents the thumb. The bay is a caldera within a caldera. It was formed by a volcanic explosion that occurred about 162,000 years ago. The resulting caldera later filled with water forming an extension of Yellowstone Lake.

Where can I see wildlife?
In summer, look for bison, elk, and mule deer around West Thumb Geyser Basin and in meadows along Big Thumb Creek; waterfowl, bald eagles, and osprey along the lake shore; ground squirrels, marmots, red squirrels, and other small mammals throughout the area. In winter, look for river otters along the shores of West Thumb where underwater hydrothermal features melt holes in the ice.

How deep is Abyss Pool?
About 53 feet; Black Pool is about 35–40 feet deep.

How hot are the springs at West Thumb?
Temperatures vary from less than 100°F to just over 200°F.

The West Thumb Paint Pots aren't like they used to be. What happened?
Like all hydrothermal features in Yellowstone, the West Thumb Paint Pots change over time. They became less active and more fluid in the 1970s. In the 1990s, they became more active; new mud cones periodically throw mud into the air.

Why doesn't Grant Campground open before late June?
Grizzly and black bears frequent this area in spring when cutthroat trout spawn in five streams here. To help prevent bear/human conflicts, the campground opens after most of the spawn is over.

What happened to the development at West Thumb?
The gas station, marina, photo shop, store, cafeteria, and cabins were removed in the 1980s to protect the fragile hydrothermal features and improve the quality of visitor experience. The development at Grant took the place of most of these facilities.

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Fishing Cone

Formation

The large circular bay of West Thumb is an excellent example of a volcanic crater or caldera. A powerful volcanic explosion about 162,000 years ago caused Earth's crust to collapse, creating the West Thumb caldera. The depression produced by the volcano later filled with water to become this large bay of Yellowstone Lake.

The West Thumb caldera lies within the Yellowstone Caldera, which encompasses the central and southern portions of the park.

West Thumb Geyser Basin

The West Thumb Geyser Basin, including Potts Basin to the north, is the largest geyser basin on the shore of Yellowstone Lake. The hydrothermal features here are found on the shore and under the lake. Several underwater hydrothermal features were discovered in the early 1990s and can be seen as slick spots or slight bulges in the summer. During the winter, the underwater hydrothermal features can prevent lake ice from forming.

Walter Trumbull of the 1870 Washburn Expedition described a unique event while a

man was fishing adjacent to what is now called Fishing Cone, a geyser on the lakeshore: ". . . in swinging a trout ashore, it accidentally got off the hook and fell into the spring. For a moment it darted about with wonderful rapidity, as if seeking an outlet. Then it came to the top, dead, and literally boiled." Fishing Cone erupted frequently to the height of 40 feet in 1919 and to lesser heights in 1939. One fisherman was badly burned in Fishing Cone in 1921. Fishing at the geyser is now prohibited.

Early visitors would arrive at West Thumb via stagecoach from the Old Faithful area. They had the choice of continuing on the dusty, bumpy stagecoach or boarding the steamship "Zillah" to continue the journey by water to the Lake Hotel. The boat dock was located near the south end of the geyser basin near Lakeside Spring.

Wildlife

Elk cows and their new calves are frequently seen in May and June. Grizzly bears, though seldom seen, are here too—especially during trout spawning season, when they can easily catch fish in shallow streams. In winter, pine marten tracks cross the snow. On the frozen bay, river otters pop in and out of holes in the ice that are caused by underwater thermal vents. Coyotes eat the fish scraps, as do bald eagles. In the summer, bald eagles and osprey dive into the bay to catch cutthroat trout. Other summer birds include bufflehead and goldeneye ducks, and common loons. Ravens are year-round residents. In the winter, they can unzip and unsnap the packs of snowmobilers, flying off with whatever they find.

Heart Lake

Lying in the Snake River watershed east of Lewis Lake and south of Yellowstone Lake, Heart Lake was named sometime before 1871 for Hart Hunney, an early hunter. Other early explorers in the region incorrectly assumed that the lake's name was spelled "Heart" because of its shape.

The Heart Lake Geyser Basin begins a couple of miles from the lake and descends along Witch Creek to the lakeshore. Five groups of hydrothermal features comprise the basin, and all of them contain geysers, although some are dormant.

The small range of mountains located just west of Heart Lake, the Red Mountains, includes 10,308-foot Mount Sheridan. Another peak, Factory Hill, was named because of the nearby steam vents, which N.P. Langford described in 1871: "Through the hazy atmosphere we beheld, on the shore of the inlet opposite our camp, the steam ascending in jets from more than fifty craters, giving it much the appearance of a New England factory village."

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Mt. Sheridan, as seen from Heart Lake

Craig Pass

Craig Pass, at 8,262 feet on the Continental Divide, is about eight miles east of Old Faithful on the Grand Loop Road. In 1891, U.S. Army Corps of Engineers Captain Hiram Chittenden discovered Craig Pass while he was surveying. It was probably Chittenden who named the pass for Ida M. Craig (Wilcox), one of the first visitors to cross the pass on the new road.

Isa Lake, at the pass, was also named by Chittenden. At one time, it was probably the only lake on Earth that drained naturally to two oceans backwards, the east side draining to the Pacific and the west side to the Atlantic. If this still occurs, it is only at the peak of snow melt after winters with deep snowfall.

Shoshone Lake

Visible from an overlook near Craig Pass, Shoshone Lake is the park's second largest lake, the site of a geyser basin, and the source of the Lewis River. Fur trapper Jim Bridger may have been the first European American to visit this lake, in 1833. Fellow trapper Osborne Russell certainly reached the lake in 1839. In 1872, Frank Bradley of the second Hayden Survey gave the lake its official name—the same name that area tribes gave the Snake River.

Shoshone Lake is thought to be the largest lake in the lower 48 states that cannot be reached by road. Its maximum depth is 205 feet and it has an area of 8,050 acres. Originally, the lake was barren of fish because they were blocked by waterfalls on the Lewis River. Lake and brown trout were planted beginning in 1890, and the Utah chub was apparently introduced by bait anglers.

The Shoshone Geyser Basin, reached by hiking or by boat, contains one of the highest concentrations of geysers in the world—more than 80 in an area 1,600 x 800 feet. Hot springs and mudpots dot the landscape between the geyser basin and the lake.

Snake River

The Snake River is a major tributary of the Columbia River and has its headwaters just inside Yellowstone on the Two Ocean Plateau. Its source was debated for a long time. The problem was to find the longest branch in the Two Ocean Plateau, which is thoroughly crisscrossed with streams. Current maps show the head of the Snake to be about 3 miles north of Phelps Pass, at a point on the Continental Divide inside Yellowstone National Park. A number of springs gush forth upon the hillside, which is about two miles above sea level. Uniting, they form a small stream, which flows through Idaho, joins the Columbia in Washington, and then to the Pacific. The Snake River is the nation's fourth longest river; 42 miles of it are in Yellowstone National Park.

DAY HIKES

Yellowstone Lake Overlook: Moderately strenuous; 2 miles round trip. Follows mostly level terrain then climbs 400 feet to an overlook in a high mountain meadow with a commanding view of the West Thumb of Yellowstone Lake and the Absaroka Mountains. Trailhead: West Thumb Geyser Basin parking area.

Duck Lake: Moderately strenuous; 1 mile round trip. Climbs a small hill to a view of Duck and Yellowstone lakes and the expanse of the 1988 fires that swept through this area. Trailhead: West Thumb Geyser Basin parking area.

Shoshone Lake (via DeLacy Creek): easy; 6 miles round trip. Follows a forest edge and passes through open meadows to the shores of Yellowstone's largest backcountry lake. Trailhead: 8.8 miles east of West Thumb Junction.

Riddle Lake: easy; 5 miles round trip. Crosses the Continental Divide and passes through small mountain meadows and forests to the shores of a picturesque little lake. Look for moose in the marshy meadows and for birds near the lake. Due to grizzly activity, this trail does not open until July 15th and groups of four people or more are recommended but not required. Trailhead: approximately 3 miles south of the Grant Village intersection, just south of the Continental Divide sign.

Lewis River Channel/Dogshead Loop: moderately strenuous; 7 or 11 miles round trip. Travels through a fairly level forested and burned area to the Lewis River Channel. Look for eagles and osprey fishing for trout in the shallow waters. Turn around at this point for the shorter trip or continue on. Trail follows the channel to Shoshone Lake and returns via the Dogshead Trail. Trailhead: approximately 5 miles south of the Grant Village intersection, just north of Lewis Lake on west side of the road.

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